What is claimed is:

1. A method of depositing a metal layer on a semiconductor substrate, the method comprising:

providing a substrate in a process chamber;

introducing a process gas in the process chamber, the process gas comprising a metal-carbonyl precursor gas and at least one of a dilution gas and a carrier gas, wherein the ratio of the metal-carbonyl precursor gas flow rate and the process gas flow rate is less than about 0.15; and

depositing a metal layer on the substrate by a thermal chemical vapor deposition process.

2. The method according to claim 1, wherein the ratio of the metal-carbonyl precursor gas flow rate and the process gas flow rate is less than about 0.10.

3. The method according to claim 1, wherein the ratio of the metal-carbonyl precursor gas flow rate and the process gas flow rate is about 0.0625.

4. The method according to claim 1, wherein the process gas includes the carrier gas comprising an inert gas.

5. The method according to claim 4, wherein the inert gas comprises at least one Ar, He, Ne, Kr, Xe, and N_2.

6. The method according to claim 1, wherein the process gas includes the carrier gas comprising a reducing gas.

7. The method according to claim 6, wherein the reducing gas comprises H_2.

8. The method according to claim 1, wherein the process gas includes the dilution gas comprising an inert gas.

9. The method according to claim 8, wherein the inert gas comprises at least one Ar, He, Ne, Kr, Xe, and N_2.

10. The method according to claim 1, wherein the process gas includes the dilution gas comprising a reducing gas.

11. The method according to claim 10, wherein the reducing gas comprises H_2.

12. The method according to claim 1, wherein the metal-carbonyl gas flow rate is between about 0.1 sccm to about 200 sccm.

13. The method according to claim 4, wherein the carrier gas flow rate is less than about 1000 sccm.

14. The method according to claim 1, wherein the process gas includes the dilution gas having a flow rate less than about 2000 sccm.

15. The method according to claim 1, wherein the process gas flow rate is greater than about 400 sccm.

16. The method according to claim 1, wherein the chamber pressure is less than about 200 mTorr.

17. The method according to claim 1, wherein the chamber pressure is less than about 100 mTorr.

18. The method according to claim 1, wherein the substrate temperature is less than about 500° C.

19. The method according to claim 1, wherein the substrate temperature is less than about 400° C.

20. The method according to claim 1, wherein the metal-carbonyl precursor comprises at least one of $W(CO)_6$, $Ni(CO)_4$, $Mo(CO)_6$, $Co_2(CO)_8$, $Rh_4(CO)_{12}$, $Re_2(CO)_{10}$, $Cr(CO)_6$, and $Ru_3(CO)_{12}$.

21. The method according to claim 1, wherein the metal layer comprises at least one of W, Ni, Mo, Co, Rh, Re, Cr, and Ru.

22. A method of depositing a W layer, the method comprising:

providing a substrate in a process chamber;

flowing a process gas in the process chamber, the process gas comprising a $W(CO)_6$ precursor gas and at least one of a dilution gas and a carrier gas, wherein the ratio of the $W(CO)_6$ precursor gas flow rate and the process gas flow rate is less than about 0.15; and

depositing a W layer on the substrate by a thermal chemical vapor deposition process.

23. The method according to claim 22, wherein the ratio of the $W(CO)_6$ precursor gas flow rate and the process gas flow rate is less than about 0.10.

24. The method according to claim 22, wherein the ratio of the $W(CO)_6$ precursor gas flow rate and the process gas flow rate is about 0.0625.

25. The method according to claim 22, wherein the process gas includes the carrier gas comprising an inert gas.

26. The method according to claim 25, wherein the inert as comprises at least one Ar, He, Ne, Kr, Xe, and N_2.

27. The method according to claim 22, wherein the process gas includes the carrier gas comprising a reducing gas.

28. The method according to claim 27, wherein the reducing gas comprises H_2.

29. The method according to claim 22, wherein the process gas includes the dilution gas comprising an inert gas.

30. The method according to claim 29, wherein the inert gas comprises at least one of Ar, He, Ne, Kr, Xe, and N_2.

31. The method according to claim 22, wherein the process gas includes the dilution gas comprising a reducing gas.

32. The method according to claim 31, wherein the reducing gas comprises H_2.

33. The method according to claim 22, wherein the $W(CO)_6$ gas flow rate is between about 0.1 sccm and about 200 sccm.

34. The method according to claim 22, wherein the process gas includes the carrier gas having a flow rate less than about 1000 sccm.

35. The method according to claim 22, wherein the process gas includes the dilution gas having a flow rate less than about 2000 sccm.

36. The method according to claim 22, wherein the chamber pressure is less than about 200 mTorr.

37. The method according to claim 22, wherein the chamber pressure is less than about 100 mTorr.

38. The method according to claim 22, wherein the substrate temperature is less than about 500° C.

39. The method according to claim 22, wherein the substrate temperature is less than about 450° C.

40. The method according to claim 22, wherein the substrate temperature is about 410° C.

41. A processing system for depositing a metal layer on a semiconductor substrate, the system comprising:

a process chamber;

a substrate holder for receiving a substrate;

a heater for heating the substrate;

a precursor delivery system for flowing a process gas in the process chamber, the process gas comprising a metal-carbonyl precursor gas and at least one of a dilution gas and a carrier gas, wherein the ratio of the metal-carbonyl precursor gas flow rate and the process gas flow rate is less than about 0.15; and

a controller for controlling the processing system.

42. The processing system according to claim 41, wherein the ratio of the metal-carbonyl gas flow rate and the process gas flow rate is less than about 0.10.

43. The processing system according to claim 41, wherein the ratio of the metal-carbonyl precursor gas flow rate and the process gas flow rate is about 0.0625.

44. The processing system according to claim 41, wherein the process gas includes the carrier gas comprising an inert gas containing at least one of Ar, He, Ne, Kr, Xe, and N_2.

45. The processing system according to claim 41, wherein the process gas includes the carrier gas comprising a H_2 gas.

46. The processing system according to claim 41, wherein the process gas includes the dilution gas comprising an inert gas containing at least one of Ar, He, Ne, Kr, Xe, and N_2.

47. The processing system according to claim 41, wherein the process gas includes the dilution gas comprising a H_2 gas.

48. The processing system according to claim 41, wherein the metal-carbonyl gas flow rate is between about 0.1 sccm and about 200 sccm, the dilution gas flow rate is less than about 2000 sccm, and the carrier gas flow rate is less than about 1000 sccm.

49. The processing system according to claim 41, wherein the chamber pressure is less than about 200 mTorr.

50. The processing system according to claim 41, wherein the chamber pressure is less than about 100 mTorr.

51. The processing system according to claim 41, wherein the substrate temperature is less than about 500° C.

52. The processing system according to claim 41, wherein the substrate temperature is less than about 450° C.

53. The processing system according to claim 41, wherein the metal-carbonyl precursor comprises at least one of $W(CO)_6$, $Ni(CO)_4$, $Mo(CO)_6$, $Co_2(CO)_8$, $Rh_4(CO)_{12}$, $Re_2(CO)_{10}$, $Cr(CO)_6$, and $Ru_3(CO)_{12}$.

54. The processing system according to claim 41, wherein the metal layer comprises at least one of W, Ni, Mo, Co, Rh, Re, Cr, and Ru.